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Chapter 11

GENERAL DISCUSSION

AIM & OUTLINE

'Money makes the world go round'¹. But how does money work in a strategy to improve population diets? This thesis explores the topic of the feasibility and effectiveness of food pricing strategies in order to change dietary behaviour, especially in low-income groups. For this purpose, we conducted a range of studies, starting by evaluating the cost of food in the Netherlands in a cross-sectional study. Subsequently, we conducted a Delphi study (e.g., systematic expert consultation), followed by qualitative and quantitative consumer studies in order to examine the role of price in food choice and to sort out potentially feasible and effective food pricing strategies. The results of these three studies served as input for the subsequent effectiveness studies. These final studies consisted of several experiments (all randomized controlled trials) which were conducted in a specifically developed three-dimensional web-based supermarket and in four real supermarkets. In these experiments the effects of a wide range of food pricing strategies, the placement of signs and nutrition education on supermarket food purchases were examined.

This closing chapter is a summary and synthesis of the main findings. Furthermore, results are put in a broader perspective and placed in the current societal context. Finally, future directions for research, practice and policy are provided.

MAIN FINDINGS

A healthy diet costs more than an unhealthy diet

This thesis starts by examining the costs of food in the Netherlands. In line with studies in other countries ¹ it was found that healthier diets are relatively more expensive: energy dense diets provide most calories for money and diets containing sufficient amounts of fruits and vegetables cost most. This finding is the basis of one rationale for considering food pricing interventions.

The development of potential feasible and effective food pricing strategies

The next steps were to explore the role of price in food choice and to find potential feasible and effective food pricing strategies to stimulate healthy eating. We first performed a Delphi Study. This study design enables finding solutions for complex problems by involving representatives of different sectors using a systematic approach.

1 From the musical Cabaret 1966

Subjects in this study included experts from academia, industry, retail, agriculture, policymakers, and consumer- and non-governmental organizations. The outcome of this study was a list of food pricing strategies that were judged as having good potential from experts' viewpoints. Subsequently, these strategies were tested on their perceived feasibility and effectiveness among consumers using a focus group and a quantitative questionnaire study. These consumer studies additionally examined the role of price in food choice. Results shown in chapter 4 and 5 revealed that mainly consumers with a relatively low SES considered price to be a core factor in food choice and experienced financial barriers when buying certain foods. Linking the outcomes in chapter 3, 4 and 5 on promising food pricing strategies, we concluded that both experts and consumers agree on the potential success of making relatively healthy foods cheaper by either discounts or price cuts. Both experts and consumers were more negative about taxing relatively unhealthy foods, mainly because they did not consider taxation a feasible alternative.

Virtual Supermarket studies: The effects of various food pricing strategies on food purchasing behaviour

The next step was to evaluate how consumers truly react upon the suggested price changes. Because supermarkets are the primary point of purchase for most consumers^{2,3}, a retail setting was considered the most appropriate price intervention setting. However, supermarket studies (especially with experimental designs) are costly and difficult to implement. In order to find a solution to this problem, we developed a research tool which can be used to study the effects of food price interventions in a virtual retail setting: the Virtual Supermarket (Chapter 6). In Chapter 7, 8 and 9 the results of three randomized controlled trials with different pricing strategies using this web-based supermarket are described. All three trials showed that lowering the prices of healthy food products in general, or on fruits and vegetables in particular, is effective in increasing the purchased amounts of these products. For example, participants that were provided with a 50% discount on healthier food items purchased 6.6 more of these items compared to participants that were provided with normal prices (on a total of around 60 food items). However, Chapter 8 and 9 revealed that discounting healthy food items may also lead to a significant increase in total calories purchased. Such side effects were not observed in Chapter 7 where exclusively fruits and vegetables were discounted.

Chapter 8 also includes the results of an experiment in which we increased the prices of unhealthier food items up to 5%, 10% and 25% in addition to no discount, a 25%

discount or a 50% discount on healthier products. It was hypothesized that discounts on healthier products combined with price increases on unhealthier products would lower the number of unhealthy products purchased. However, while the purchased number of unhealthy products was somewhat lower in the taxation conditions, no statistically significant effects of the price increases were found. Taxes higher than 25% may be required to result in significant behaviour change. Finally, in addition to pricing strategies alone, the Virtual Supermarket was used to study the effects of promotion signs signalling that a product was “on sale” or “a healthier choice” or “on sale plus a healthier choice”. As described in Chapter 9, we found no difference in number of healthy products purchased between conditions with those different signs. Furthermore, when these outcomes were compared with the results presented in chapter 7 and 8, no considerable supplementary effects of the signs in addition to the effects of the discounts could be seen either.

The effects of a 50% discount on fruits and vegetables and nutrition education in real supermarkets

The results of the Virtual Supermarket studies showed that lowering the prices of healthy foods was effective in stimulating the purchase of these products. Moreover, a subsidy exclusively on fruits and vegetables was found to have the best overall effects. These findings bring important new insights into the effects of food price interventions in a retail environment. A strong point of the virtual supermarket studies was the internal validity due to a highly controlled environment. However, a limitation of this type of study is the external validity. This makes that a trial in real supermarkets was required to validate our results and make them more generalizable to the real world situation ⁴. In the final chapter in this thesis the results are presented of a nine month (six months intervention) randomized controlled trial examining the effects of a 50% discount on fruits and vegetables and nutrition education on supermarket food purchases. This study was conducted in four Dutch supermarkets (see Figure Appendix 11.1). The discounts were provided by use of coupons (See Figure 11.1). The nutrition education consisted of specifically designed recipe books and telephone counseling calls building upon the principles of Motivational Interviewing (MI) ⁵.

Results of this trial showed that the discount coupons were used a lot by the participants and lead to a substantial increase in fruit and vegetable purchases from baseline to six months. Moreover, results showed significant positive effects of the price plus education intervention on fruit and vegetable purchases in both the crude

and adjusted models. The adjusted multilevel models revealed the following effects for this group compared to control at six months: +3 kilogram fruit ($p=.005$), +1.6 kilogram vegetables ($p=.05$) and +4.7 kilogram fruits plus vegetables ($p=.002$) per household (average = 3.1 persons) per two weeks. This is equal to an average of 113 gram extra fruit and vegetable purchases per person per day. In addition, crude models revealed significant positive effects for the price discounts alone and at one month time. An important notion on our results is however that the adjusted models only



Figure 11.1 An example of discount coupons in the real supermarket trial

showed statistically significant effects of the price discount *plus* nutrition education and only at 6 months. Therefore, accompanying strategies may be needed to enforce the effects of pricing alone; this seems also relevant when considering long-term effects of pricing strategies. Nevertheless, also the effects of pricing alone seem relevant, especially since the percentage of participants consuming sufficient amounts of fruits and vegetables (≥ 400 gram/day) increased from 42.5% at baseline to 61.3% at six months in both discount groups. No significant effects of the education intervention alone were found. Also there were no indications that participants spent the extra money in other categories. Based on these results, we propose that lowering the prices of fruits and vegetables by use of special discount offers is a promising intervention strategy to stimulate the purchases of these products.

Conclusions

The studies presented in this thesis show that the healthy choice is the relatively expensive choice; that price fundamentally affects food choice and may even form a barrier for low SES consumers in selecting healthier foods. These findings make pricing strategies a justifiable tool to stimulate healthier choices. Opposed to taxing unhealthier foods, making healthier foods cheaper was found to be the most *feasible* pricing strategy to implement. In addition, lowering the price of healthy foods (either by discounting all healthier foods or only fruits and vegetables) was found to be *effective* in stimulating the purchase of these products. Nevertheless, discounting all healthier food items was also found to be related with extra calorie purchases. This may not be a problem in people with a normal weight, but most people with a low SES are overweight or obese. Overall, a subsidy exclusively on fruits and vegetables was found to have the best effects; this strategy did not result in extra calorie purchases and did lead (both in our virtual and real supermarket trials) to a substantial increase in fruit and vegetable purchases. We did not find any effects of the educational intervention alone, but did find that the effects of the food pricing intervention were enforced by the educational program, showing that additional communication may be required to strengthen the effects of food pricing strategies. Nevertheless, food pricing strategies are considered to be more powerful to change population dietary behaviour than programs that rely on individual determinants of behaviour change ⁶. A point of concern in our studies is that the results do not reveal how lower fruit and vegetable prices affect purchases in domains outside the supermarket such as eating out or smoking. Therefore, we cannot draw firm conclusions on the effects of food pricing strategies on important non-communicable diseases or definitive health outcomes.

STRENGTHS AND LIMITATIONS

A major strength of the work performed in this thesis is the use of a mixture of study designs which, put together, enable triangulation of our findings and provide insight into the topic of food pricing strategies from different perspectives. The systematic build up makes that the results presented here bring not only strategies that are effective in a highly controlled environment, but are also feasible to implement under real circumstances. Within this process we used experimental study designs (randomized controlled trials) to test the pricing strategies which make that the results are valid. Another important strength is that we were the first to develop a three-dimensional web-based supermarket which enabled us to test many different pricing interventions in a supermarket setting which would have been impossible in real supermarkets. A key strong point of the Virtual Supermarket is that we were able to use it to test the pricing strategies in a highly controlled environment, providing a high level of internal validity. Moreover, the Virtual Supermarket has very good potential for other research projects and is therefore currently translated into an English language version. Finally, it is considered a strong point that we finalized our series of studies by means of a randomized controlled trial in four real supermarkets, putting our virtual results to the test in real life. Up to date such large supermarket trials are very rare (with to our knowledge only two comparable trials conducted world-wide)⁷⁻⁹ and our experiment was by the start of the intervention unique in Europe. An important attribute of this study is that we used firm outcome measures (e.g., cash receipts) to measure food purchases. An advantage of this method is that the data are objective, rather unaffected by recall bias, overrepresentation of occasional purchases, or social desirability commonly encountered in traditional surveys¹⁰⁻¹². A limitation of this method is however that it focuses on food *purchases* rather than food *consumption*. People may take advantage of the price discounts by stockpiling their extra purchases rather than consuming them^{13, 14}. However, research shows that stockpiling also leads to increased consumption and fruits and vegetables are less suitable for stockpiling because they are perishable products¹⁵. Besides, we did measure fruit and vegetable consumption by a shortened FFQ, which was used to determine the change in percentage of participants that consumed sufficient amounts of fruits and vegetables from baseline to six months. Here we found a substantial increase in the discount groups while no change was observed in the non-discount groups. FFQ's are considered valid for making such classifications¹⁶, and the results form an extra support for the findings measured by the cash receipts.

Another strong point of our real supermarket trial is that we carefully monitored the effects on food purchases by including supermarkets in areas with limited other shopping occasions, by including study participants who indicated to be regular shoppers in the participating supermarkets and by adjusting for purchases elsewhere. This is very important because it can be expected that the discount coupons may have driven participants in these particular groups to visit the participating supermarkets more frequently than the non-discount groups. A consequently limitation to the selection of these supermarkets is however that they were located in four relatively small villages in rural areas (Sint Nicolaasga was the smallest with a population size of around 3,300 and Biddinghuizen the largest with a population around 6,100). Possibly, people living in urban areas with a broader range of food purchase options, including daily markets and specialized fruit and vegetable shops, react differently to food pricing strategies. In our experiment, purchases outside the participating supermarkets also had significant effects on the effectiveness of the discount coupons to increase fruits and vegetable purchases. It was found that the largest effects of the discounts were found among participants who purchased all their groceries at the participating supermarkets. It is therefore interesting to know how people react upon discounts that apply to all possible points of purchase and, more importantly, what the exact total fruit and vegetable purchases will be. Still we do not suggest that people in larger cities such as Amsterdam will have a different response to food price changes than people in Sint Nicolaasga; price is quite a uniform concept and the Netherlands is a small country with relatively small differences between urban and rural areas. Also supermarkets are the dominant food environment suggesting that price discounts in this point of purchase have significant effects nationwide. Nevertheless, the strongest effects of lower fruit and vegetable prices can be expected when these prices apply to all points of purchase.

All together, the studies in this thesis form a solid basis for food pricing research. Nevertheless, our work has also some important limitations in addition to the points already mentioned above. First, our outcome measures were limited to supermarket purchases meaning that we did not capture effects in other domains such as eating out. This makes that based on our studies we cannot draw firm conclusions on the effects of pricing strategies neither on overall diet quality nor on future health outcomes. As will be discussed later in this chapter, it is of main importance to conduct studies that do examine such effects by including overall household expenditures. Another important point to be considered is the external validity of our studies and the extent

to which our results can be generalised. Here it is relevant to look at potentially selective response rates and drop out. During the experimental studies we made effort to keep drop out rates low. In the virtual supermarket studies, drop out rates were 28% in experiment 1; 17% in study 2 and 24% in experiment 3. In experiment 2, drop outs were found to be somewhat older ($\Delta=7.42$ years) and having a smaller household size ($\Delta=.82$ persons) than the final sample, in the other experiments no significant differences were observed. Drop out rates did not differ between the different research conditions. In the real supermarket experiment 76% of respondents were included in main analysis. Here drop outs were relatively more often men, from the lower income groups and not evenly distributed over the four supermarkets. Again, drop out rates did not differ between the research conditions. Compared to similar studies this dropout rate is relatively low. For example, Bihan and colleagues had to restrict their analysis to a 3 month time frame due to a significant loss to follow-up in the subsequent measurement rounds (76% loss to follow-up at 9 months)¹⁷. Selective drop-out can have important influences on study outcomes and our results should therefore be interpreted with the caution that the results apply to our study population and may not pertain in other populations¹⁸. This caution also applies to non-response rates. For the participant recruitment in the RCT's we used strategies that could theoretically reach thousands of people (for example via newspaper articles). This method was effective in finding sufficient study samples, but may have led to selection bias and does not provide insight into the characteristics of the non-responders¹⁸.

Another point to be considered is that in most studies we aimed at recruiting participants with a relatively low socio economic status (SES). Because Dutch people are generally reluctant to provide details about their income, we used education level (medium secondary or below) and/or employment status (unemployed) as indicators of a relatively low SES. Despite this procedure, most studies still included a substantial percentage of participants with an income considered to be above standard in the Netherlands. In the supermarket trial this percentage was 29%. Because financial barriers against healthy food purchases are an important argument for introducing food pricing strategies, it may be important to study the effects specifically in low-income populations. Also, this is the group where price is mainly important in food selection¹⁹. However, since our results indicate that food pricing strategies are effective in samples with a relatively high number of participants with an income above standard as well, in it can be expected that they are equally (or even more) effective among people having limited financial recourses. A related limitation with respect to

our study populations in the RCT's is that migrants may have been underrepresented, especially when considering their share in the lower SES groups. In the Netherlands, 11.4% of the population consists of migrants from non-western countries (e.g., persons of which at least one parent is born outside the Netherlands). The largest part of this group comes from Turkey (2.3% of total Dutch population) and Morocco (2.1% of total Dutch population)²⁰. Since these migrant populations generally have lower education levels, lower income levels and are more often unemployed than the native Dutch population ²¹ a major part of the lower SES groups is formed by these minority groups ²². It can be expected that these people react differently to food pricing strategies because they have a different cultural background and other dietary habits compared to the native Dutch population. Nevertheless, we did deliberately include some Turkish and Moroccan migrants in the focus group study and found that these groups reacted similarly to food pricing strategies as the autochthonous Dutch participants ²³. Moreover, for the internal validity it is beneficial that we were able to include quite a homogenous population in our experimental studies. A final point to be mentioned is that our results apply specifically to the Dutch situation; research is needed to validate our results in other countries with other food prices and other dietary habits.

WHAT'S NEXT: REFLECTIONS & FURTHER RESEARCH

The results of this thesis suggest that lowering the prices of fruits and vegetables would be the most feasible and probably most effective food pricing strategy to stimulate healthier food purchases. Nevertheless, in October 2011 the Danish government introduced a pricing measure in the other side of the spectrum: a fat tax. Specifically, the measure consisted of a price increase of around €2.15 on every kilo of saturated fat on any food that contains more than 2.3% saturated fat. Also Hungary introduced a tax on unhealthy food items ²⁴. It may be interesting to note that the initial effect of the Danish fat tax was that people stockpiled the products that were pointed out to be affected by the taxes, leading to empty supermarket shelves. At this time, the effects on health are however unknown. Hopefully, both Hungary and Denmark have a solid system of keeping track of the consequences of the taxes. This would be very valuable information in determining the true effects of food pricing strategies. In a New Scientist opinion article professor Marion Nestle writes: 'In the meantime, let us congratulate Denmark on what could be viewed as a revolutionary experiment. I can't wait to see the results' ²⁵.

While, the study of price as a tool in steering consumer behaviour is relatively new in the field of public health, it has already been heavily studied in other domains for decades. For example, in its first volume (1964), the *Journal of Marketing Research* published an article on understanding price determinants²⁶ and numerous papers on the price topic have been published since then. In a review on sales promotion and food consumption Corinna Hawkes even states that “there is no doubt that sales promotions lead to an increase in sales of the promoted product during the period of the promotion”²⁷. Indeed, there is substantial academic literature showing that price is important in steering consumer behaviour and is used widely as an incentive to buy certain products^{27,28}. Within the Marketing Mix (McCarthy 1960) price is considered the dominant factor along with the other three p’s standing for product, placement and promotion²⁹. Despite this clear role of price in steering consumer behaviour, research in the fields of economic and marketing research seems to have trouble in predicting the effects of prices on consumer behaviour. Knowledge from these fields can thus not be directly used to answer questions on the effectiveness of food pricing strategies. For example, the effects of increased sales due to a price promotion could work via different mechanisms being “product substitution”, “forward buying”, “purchase acceleration”, “brand switching”, “product testing”, or “repeat purchasing” which all are expected to have different effects on the definite consumption pattern²⁷. As illustrated by Grewal and Levy (2007) pricing is one of the most difficult issues facing retailers³⁰. In the following sections, I will incorporate some relevant knowledge from marketing and economic research into the case of food pricing strategies to stimulate healthy eating. Here, I will list a range of issues that requires further examination before food pricing strategies can be indicated as a solution in stimulating population health, these issues include most importantly the long term and multi-dimensional effects of food pricing strategies³¹.

The concept of price

The Oxford dictionary refers to price as ‘the amount of money expected, required, or given in payment for something’. When applying the economic viewpoint to health behaviour, a useful model is the economic framework of human physical activity and nutrition behaviour, called: **S**leep, **L**eisure, **O**ccupation, **T**ransportation, and **H**ome-based activities (SLOTH) model. SLOTH can be used to indicate how people allocate their scarce resources of money and time in order to maximize their utility³². Most people are constrained in their financial resources and time; therefore people will spread their money and time on products in a way that gives them the highest utility.

This has important implications for food pricing strategies. If food prices change, it is expected that people reallocate their budget to this new situation in order to obtain a new ultimate state of utility. How the budget is reallocated is shaped by preferences; economic interventions do not aim to change decisions by changing these preferences, but by changing (relative) prices ³². Health is only one factor contributing to peoples' utility and people may favour utility benefits of unhealthy behaviour against higher risk of mortality. Utility theory (Thaler 1985) describes that there are two types of utility associated with consumer purchases: *acquisition utility* and *transaction utility*. The first is defined as the benefit that is derived from the utility of the purchased good minus the price of that good. The second implies the satisfaction that is related to the financial terms of the deal per se. This satisfaction is based on the internal *reference price* and can be high when people observe they have made a good deal ³³.

Reference prices

Reference prices are an important concept when studying the reactions of consumers to new and current prices. When considering price, consumers do not always have accurate knowledge of the price. In fact, there are indications that people have a very bad recall of prices. For example, Dickson and Sawyer conducted a study in which they interviewed 802 shoppers about the products they just purchased (they were interviewed directly after putting the product in their cart). They found that 21.1% could not even give a price estimate of the selected product and 31.8% gave an inaccurate one ³⁴. Just and Payne argue that price may not be the best incentive to stimulate healthy food purchases because, like health messages, the response to price relies too much on cognitive factors ³⁵. Other research however states that these low accuracy scores can be explained by the fact that consumers do not try to remember the actual price, but merely link prices to a reference price ³⁶. This means that they tend to compare the price of an item with a similar product, or a promotional price (external reference price) and compare prices with remembered prices such as prices in other supermarkets (internal reference prices). It is important to note here that it is not pure the price, but also the concept of value that is essential. Price is not only a negative construct (e.g., losing money) but also a positive one (if a product costs more, it must be of higher quality)³⁷. The concept of reference prices and value has also implications for the design of food pricing strategies as will be discussed next.

The run to the stores in the case of the Danish fat tax shows that at start people react strongly to price changes. Also, the largest Dutch supermarket chain comes

regularly with a promotion stunt called ‘Hamster Weeks’ in which people can buy a whole range of products for relatively low prices and squirrel these products away. In fact, around 29.5% of total annual average food expenditures are on products that are on sale ³⁸. These examples show how powerful price changes can be in influencing consumer behaviour, which was also confirmed in the experimental studies in this thesis. An important implication of reference prices is however that people may eventually become unaware of the new prices, especially when prices of a whole product range are changed at a certain point in time (such as with the Danish fat tax) ³⁹. It is evident that pricing strategies should not only work today, tomorrow, next week or even next year, but in fact should last for ever. This includes new generations of shoppers who were not making purchasing decisions before the introduction of the pricing strategies. An important issue here is that promotions can change reference prices meaning that people expect different (e.g., lower) prices ⁴⁰. However, when looking into previous monetary strategies in the public health domain, the effects seem promising. With regard to tobacco control it was found that US smoking rates decreased between 1997 and 2003 which was most explained by increased prices with a continued effect through time ⁴¹. Also there is clear support for the view that higher prices for alcohol have been successful in decreasing drinking, heavy drinking and improving alcohol-related health outcomes and that these effects were sustained ⁴². These effects may be somewhat different with regard to lowering the prices of fruits and vegetables (different products, different pricing strategy), but do show that monetary interventions have a potential.

Price cues and adaptation levels

One solution for prolonging the effects of food pricing strategies is the use of pricing cues (e.g., signs). Cues also seem relevant when considering the concepts of habit, impulsivity and reference prices (people may rely on cues to update their price expectations). If people have a strong habit for certain food purchases, they may be less aware of silent price changes. However, strong cues may give them an incentive to change their consumption pattern. Also impulsive buying is an important concept. Insights from consumer psychology reveal that consumer choices are mostly not rational, but merely unconscious and heavily influenced by environmental factors such as supermarket cues ⁴³. These unconscious decision processes can however be steered with certain primers ⁴³. For example, work by North and colleagues revealed that French music played in a store led to higher sales of French wine whereas German music led to higher German wine sales ⁴⁴. Also components known from

the marketing mix (e.g., product, place, price or promotion) could serve as such primers ²⁹. A psychological concept that brings a solid frame for the way in which shopping information is processed is adaptation-level theory (Helson, 1964). This theory postulates that a consumers' behavioural response to stimuli represents the level of adaptation to environmental cues. The way a stimulus is perceived depends on the relationship between the present value of that stimulus and the present value of the current adaptation level ³⁶. Thus, a cue will get a stronger reaction when this strongly deviates from the remembered cue. This applies to changing food prices in a way that people need to become aware of (e.g., adapt to) the new prices. In our focus group study it was found that consumers are interested in information which tells them both about the healthiness and the special offer of a product ²³. A study on consumer responses to snack food taxes and warning labels found that it may be more important to tell people that products are taxed than to actually tax it ⁴⁵. This phenomenon also works for lowering prices. Previous research showed that people have the tendency to buy a product simply because it is on sale or cheaper now ^{40, 46}. Going beyond that, there is evidence that people react to a sale sign without an actual price discount. Anderson and Simester found that using the word 'sale' beside a price (without actually varying the price) can increase demand by more than 50% ⁴⁷. Also the way of framing the price seems to be important. Research found that the use of \$9/€9 endings increases demand because people link this ending to a promotion price ⁴⁸. While we did not find significant effects of sales signs in our study in chapter 9, we do suggest that it is important to incorporate such communicative cues when introducing lower prices on healthy food items. As was also discussed in chapter 9, the absence of significant effects of the sales signs may have been due to our experimental set up and therefore future research is warranted to examine the effects of price cues more closely.

Future Research

The studies described in this thesis describe substantial new findings on the effects of food pricing strategies. However, in the previous paragraphs I have also mentioned some points that require deeper examination to unravel the effectiveness of food pricing strategies, or more specifically the effects of lowering fruit and vegetable prices. In this paragraph I will list the challenges that lie ahead and which elements should be incorporated in further research.

When thinking about future food pricing studies, the most important challenge is to find out whether and how these strategies can be effective in improving *health*. In

other words, the suggested pricing strategies must not only result in healthier food purchases, but also in fewer unhealthy food purchases and should not lead to other undesired outcomes such as higher smoking rates. According to economic theory, the percentage change in the quantity demanded of a certain good (e.g., yoghurt) in response to a given percentage change in the price of another good (e.g., fruits and vegetables) is being referred as cross-price elasticity of demand ⁴⁹. In a recent study, it was found that the likelihood of a price promotion in a category affecting the sales in at least one other category is 0.61 ⁵⁰. Increased food prices (by taxes) were found to have such cross-price elasticity effects as well. Mytton and colleagues found that fruit purchases tended to fall as a result of taxation on milk and cream ⁵¹ and Nederkoorn and colleagues found that people tended to replace more expensive energy-dense products with cheaper alternatives as a result of a tax on energy-dense foods ⁵². It is evident that studies are needed that examine cross-price elasticity and overall effects of food pricing strategies carefully ^{51,53}. A limitation of the present studies (included the ones in this thesis) with regard to this aspect is that they are restricted to a limited side of spectrum (in this thesis to supermarket purchases). Food price changes, especially when they are large, can be expected to have effects in various domains ⁵⁴. In the focus group interviews participants hinted using saved money from fruit and vegetable discounts to buy cigarettes. Therefore, future studies should make an effort to incorporate overall household expenditures. Such measures could consequently be incorporated into simulation modelling studies which can be used to estimate the effects of changes in complex systems and their impact population health ⁵⁵. An example of such a simulation model is DIETRON, which models the impact of dietary interventions on food consumption, cardiovascular disease and cancer mortality ⁵⁶. Also the Dutch ‘Chronic Disease Model’ which has been developed by the National Institute of Public Health and the Environment is a good quality model for such calculations. This model incorporates the relation between risk factors and the incidence of twenty major chronic diseases and can be used to calculate the related health care costs of the chronic diseases under study as well.

Besides including overall household expenditures as an outcome measure it is also highly relevant that future interventions are sustained over a longer time period, at least a couple of years. Here it is relevant that an effort is made in capturing transaction utility (e.g., when reacting on a price promotion, people also consider future prices and react upon the need of not missing out on a good deal)^{47,57}. Also the design of the pricing strategy warrants further research. We found that discount coupons are

very effective to stimulate fruit and vegetable purchases. A merit of using coupons is that they can be specifically targeted at low SES consumers who are most in need for such financial incentives, for example by incorporating them into existing schemes such as the Food Stamp Program ⁵⁸, the Special Supplemental Nutrition Program for Women (WIC) ^{59,60} or Food Assistance Programs. Nevertheless, it can be argued that incentives that reduce economic barriers for healthy eating at population level have greater impact and are more sustainable than individual focused interventions (such as coupons) ⁶. We suggest that future research should focus on these aspects and unravel whether coupons or general discounts would have the best effects ³³. Here it is relevant to consider that the effects can be affected by the frequency of price promotions ³⁹ and the depth of the price change ⁵⁰. In Chapter 8 we describe the effects of different levels of price decreases on healthy products and price increases on unhealthy products. In this study it was found that higher price decreases (50%) are considerably more effective than lower price decreases (25%). Also, price increases (taxes) up to 25% were not found to significantly affect unhealthy food purchases. Other studies did find significant effects of price increases >25% on high caloric foods ⁶¹ and thus also this type of strategy may mainly be effective in changing consumer behavior when the price change is large. More research is needed to study such effects further and to determine which levels of price change are most effective in obtaining the projected results. Finally, it can also be expected that price changes have different effects among different types of consumers. Our study samples were not large enough to capture such differences, but future research should aim to make good quality consumer segmentations, mainly with regard to high and low income consumers. In conclusion, the major challenge in future food pricing research is to unfold the effects on health outcomes. In order to do this, studies should incorporate long term effects, measure overall household expenditures, differentiate ways to amplify the effects of the price changes (cues or education), effects on different types of consumers, the best type and design of the pricing strategy and measure health outcomes. Here the focus should be on pricing strategies stimulating healthy food purchases and lowering unhealthy food purchases. Suggestions for how such strategies could be designed and implemented plus implication for policy and practice are given in the next section.

IMPLICATIONS FOR POLICY AND PRACTICE

During the course of this project, food pricing strategies were getting an increasingly prominent place in the public debate. For example, in 2009 we wrote an advisory

report to the Dutch government about the use of food pricing strategies to stimulate healthy eating ⁶². This report was initiated by questions from members of the Lower House. Our conclusion was that healthier diets are relatively expensive, that price is an important factor in food choice and that food pricing strategies should therefore be seriously considered as a strategy to stimulate healthier food choices. We advised that the best direction would be lowering the prices of healthy foods, but mentioned that solid scientific evidence on the effectiveness of this strategy is missing. The responsible Minister at that time (Ab Klink) did not favour the introduction of food pricing strategies by the government and argued that the evidence on the effectiveness of pricing strategies is too small and that healthy food choices are more the responsibility of the industry and individual consumers. In December 2011, the Dutch Council for Public Health and Health Care (RVZ) also advised the government to look at food pricing strategies as a measure in the prevention of welfare diseases. Their particular advice was to explore how a fat tax or a higher VAT rate for all foods could be realised ⁶³. Furthermore, also the WHO advises member states to consider fiscal policies to stimulate healthy food choices ²⁴. All in all, different parties recommended that governments should look into food pricing strategies to stimulate healthy eating. While the RVZ advised to look into taxes or higher VAT rates, this thesis concluded that lowering fruit and vegetable prices would be the most feasible and effective strategy to stimulate healthy eating. Based on the results in this thesis, providing fruit and vegetable discount coupons to the lowest income groups (and monitor the effects closely) would be the best place to start. However, there are also other ways to look at food prices. Questions that arose during this project were for example ‘how are food prices constituted?’ and ‘what is the role of agriculture, trade, and supermarkets?’ In the next paragraphs I will list some ideas about how we can use existing schemes to address creating healthier population diets by changing food prices. Also, I will explore the potential role of supermarkets and governments. Furthermore, I will talk about the interrelation of health and sustainability and the potentials that lie within interdisciplinary solutions.

The constitution of food prices

An important footnote in the picture of food prices is that our food (in wealthy industrialized countries) is evidently too cheap. Especially in the Netherlands food prices are very low; recent numbers provided by Eurostat revealed that Dutch food prices are around 10% lower than the EU average. This percentage becomes even more outstanding when taking into consideration that this EU average includes

numbers from countries such as Hungary and Slovakia where prices are substantially lower⁶⁴. Moreover, Dutch consumers spent a very low percentage of their income on food (13.6%) compared to our neighbour countries Luxembourg (19.9%), Belgium (17.1%) and Germany (15.0%)⁶⁵. Nevertheless, these cheap food prices do not apply to all foods. International studies have revealed that sugars and fats provide most calories for money and that fruits and vegetables are relatively expensive⁶⁶, which was confirmed in our study on food prices in the Netherlands⁶⁷. These food prices constitute via various mechanisms which cannot be left out when thinking about creating healthier population diets⁶⁸. Sacks & Swinburn have set out the levels of governance and each sector in the food system which can be targeted in obesity prevention. While our focus is not primarily 'obesity' but 'healthy diets in general', this structure does show the importance and influence of the supply side on food choices⁶⁹. Government levels range from local (land-use management) to international (trade arrangements) and powerful organisations such as the United Nations (UN) and the World Trade Organization (WTO). Sectors influencing the food system include primary production, food processing, distribution, marketing, retail and catering/food service⁶⁹. All in all, today's food supply is governed by complex systems including our global economy and world trade^{68, 70}; when truly thinking about health we cannot ignore the bigger picture showing how our food is produced and the global mechanisms that play a role⁷¹

Here it is relevant to keep the truism 'health is wealth' in mind when thinking about these policies: a flourishing economy is important, but good health is essential for a healthy economy⁷² (see Figure 11.2). Below, I will specifically discuss the role of the retail sector and governments.

The role of the supermarkets

Fruits and vegetables are delivered to the consumer via a system that consists of three major actors, being producers (national and international); wholesale and distributive trade; and retail trade. In the Netherlands, as in other industrialized countries, supermarkets are the dominant food environment. Also when specifically looking into fruits (71% of household purchases) and vegetables (84% of household purchases) supermarkets form by far the most important sale channel⁷³. Since the Netherlands only has five supermarket chains and one buyers' organisation, the retail trade in fruit and vegetables is heavily concentrated. Six purchasing points share an annual consumer turnover of € 28 billion making that supermarkets have a relatively strong negotiation position against producers⁷³. This position may have a strong influence on

the constitution of fruit and vegetable prices. Within the chain, supermarkets have by far the largest margin on fruits and vegetables ⁷³. For example, it has been found that the consumer prices for fruits and vegetables constitute by 13-17% of gross margins in the wholesale sector and 25-35% of gross margins in the retail sector ⁷³. Looking specifically into the price construction of the red pepper, it was found that a consumer price of €4.18/kilogram consists of: €1.00 cultivator price; 15 cents packaging; 4 cents logistics; 7 cents transport; 5 cents stock; and 24 cents VAT. This means that the supermarket earns €2.63/ kilo gross margin ⁷³. With this margin they have to cover distribution and loss, however it is still substantial.

Within the field there is a growing debate questioning why producers earn so little for their produce, while consumers have to pay so much. Whereas supermarkets are not the only contributor to the relatively high fruit and vegetable prices, there are two potential mechanisms through which they can contribute to lower consumer prices for fruits and vegetables. First, there are indications that margins for fruits and vegetables (and also other fresh products such as meat and dairy) are higher compared to the margins of the general supermarket assortment. While there exist no clear numbers to illustrate this difference ⁷³, a hearing by the Dutch Lower House revealed that the margins on fresh products lie within 20-45% while these are 3-4% over the whole product range ⁷⁴. The hearing revealed that supermarkets partly (e.g., in addition to losses due to wastage) use these high margins on fresh products to compensate for a loss in profit due to sales promotions on A-brands of for example coffee and beer ⁷⁴. While it is difficult to find scientific evidence for this, the relatively high supermarket margins on fruits and vegetables may be a window of opportunity. EU agricultural commissioner Dacian Cioloș did have plans to bring a new bill to create fairer margin distributions ⁷⁴. If he succeeds, this may result in lower fruit and vegetable prices in the supermarket. A second, aligning, strategy could be the introduction of bottom prices. Belgium, for example, has a system where supermarkets are not allowed to sell products beneath their original buyers' price (the price the supermarket paid for it) ⁶⁵. Such a system could prevent large powerful supermarket chains to come up with strong promotions on certain products (where they are even sold below the buyers' price) and compensate this with fruit and vegetable margins.

Another frequent mentioned suggestion to address the required changes in the food industry sector is by self-regulation. Self-regulation is characterized by being a voluntary and socially responsible industry practice having consumer welfare as major

goal ⁷⁵. Supermarkets have an important societal responsibility and have a substantial influence on consumers' food choices by the arrangement of their product assortment. Within this arrangement they can bring major contributions by launching a healthier product selection. This is a very promising approach. However, self regulation can also become a public health failure especially when this principle is used by industry to protect themselves from government regulation and to commence business as usual (no government regulations) ⁷⁵. Brownell and Warner make a link to tobacco control and show that self-regulation may only *appear* to be helpful while it is not and may also lead to unwished delays in government interventions ⁷⁶. Therefore, self-regulation may not be the (only) answer ⁶⁵. This is underlined by a recent article in BMJ bringing the news that food policy experts have requested the state to regulate the food industry and not resign from firm policy changes ⁷⁷. It indeed makes sense not only to focus at supermarkets, but also incorporate the other major operators in the food chain if we are seriously to influence food choice ⁷⁸.

The role of governmental policies

In the General Introduction of this thesis I already briefly mentioned that agricultural policies form a key component of our modern food supply system. In total, the Organisation for Economic Co-operation and Development (OECD) countries invests almost US\$ 1 billion per day into agriculture subsidies ⁷⁹. These subsidies have large effects on food supply, availability and prices and thereby on diets and ultimately population health ⁸⁰. As described in a recent paper by Mitchell and Voon, WTO members are far from using these subsidies to promote healthier eating habits. Instead, they directly or indirectly subsidize products that should be banned in the fight against non-communicable diseases such as sugar or high fructose syrup ⁸¹. Historically, the industrialization and investments in the food supply in developed countries has brought some major advantages; food became more available, varied, affordable, and starvation and famine have largely disappeared in Europe ⁷¹. However, today our agricultural system produces an overcapacity of food, an increased availability of dietary energy supplies and overproduction of certain crops ⁷⁹. This contributes to a food environment with a wide availability of low-cost foods high in fat and sugar. Moreover, the EU Common Agricultural Policy (CAP) protects fruit and vegetable producers via import tariffs and a withdrawal system both of which keep the prices high ⁸². Finally, food has become highly commercialized, thus giving a great incentive to the ones selling food to increase sales by increasing demand. At this point there are a small number of companies that control the food market and operate a system

that delivers cheap food to developed countries ⁷⁸. It can be argued that unhealthy diets are just the consequence of peoples' incapability of choosing right from plenty ⁷¹. Also it has been postulated that 'obesity can be considered a robust sign of commercial success' ⁸³.

It is therefore relevant to find opportunities for incorporating health in agricultural policies and put an end to the purely economic view of our food production. One place to start this new policy is by looking at WTO agreements; these regulations prohibit for example the use of subsidies on the use of domestic rather than imported products ⁸¹. It is interesting to think what might happen if EU import tariffs on fruit and vegetables are removed or WTO agreements are used to prohibit massive subsidies on unhealthy food products ⁸¹. While I cannot predict what the eventual effect of such rigorous measures will be, it makes more sense than creating intervention strategies to stimulate healthy eating which have to work against these powerful economic forces. I therefore believe that the true (and sustainable) solution lies in changing the

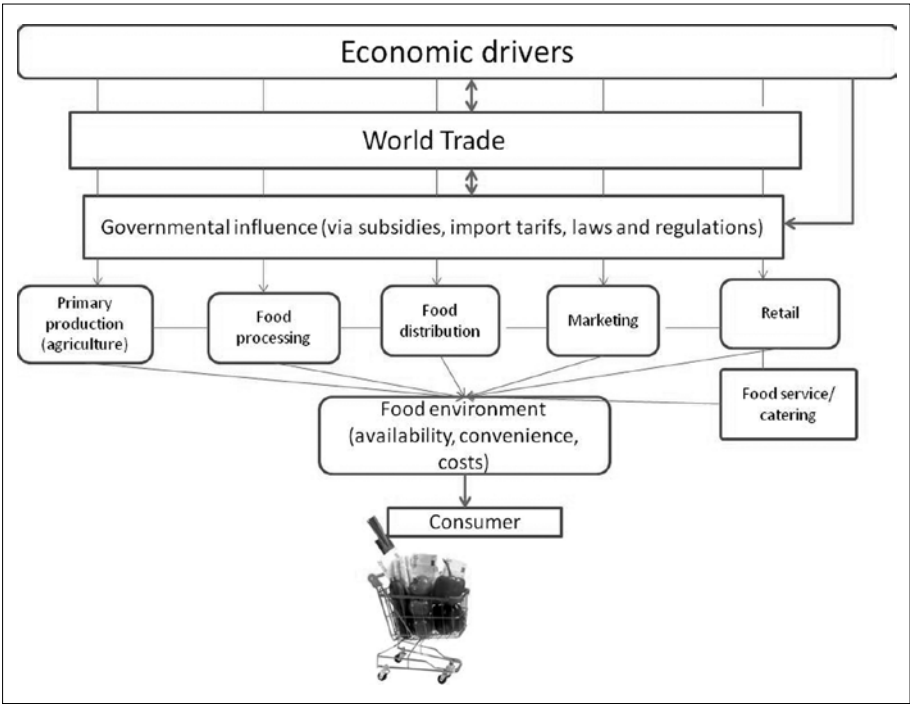


Figure 11.2 An overview of the major forces in the food supply chain

whole food system to a structure where food is produced and traded by incorporating health outcomes and towards a system where consumer food prices form a better representation of their true (production) costs (see Figure 11.2). The importance of looking into the make-up, shape and values of our society in relation to unhealthy food intake was illustrated by a recent paper by Offer and colleagues (2010) in *Economics and Human Biology*. They found that market-liberal countries in their sample (Australia, Canada, UK and USA) stand out in their high levels of obesity and their high rates of obesity growth compared to other similar affluent countries where markets are a bit more controlled (especially compared to the Scandinavian countries). This difference can be explained by the fact that the “food shock” (e.g. palatable energy dense food became more accessible and cheap) has worked more powerful in these countries ⁸⁴.

In conclusion, it can be argued that when priorities in the food chain remain to be economic driven and policies are formed to promote consumption-based growth, plus pertaining in a system that promotes market and trade liberalisation it is inevitable that neither overconsumption nor the consumption of wrong foods can be blocked by purely relying on consumer or industrial responsibility ⁸⁵. This was excellently formulated by Swinburn and colleagues in the Obesity series in the *Lancet*: ‘Solutions to obesity and to improve health cannot be based on the existing framework (consumption-driven growth creating financially-defined prosperity) because this approach helped to create the difficulties in the first place’ ⁸⁵. Some authors stress that changing commodity prices may not have the intended effects on food prices and food choices ⁸⁶. Nevertheless, their argumentation also shows some limitations ⁸⁷ and the persistent issue is what the appropriate public health, agricultural, industrial, and economic policies are to pursue in achieving balance between these interests ⁷¹. Moreover, there is not only a link to health, but also to sustainability.

Public health, climate change & sustainability

Besides the impact on health, it is also worth considering how the governance of food supply can have positive effects on sustainability and fair trade. This may also help raise priority and create new political opportunities ⁸⁸. Indeed, “enlightened policy responses would both benefit health and enhance sustainability” ⁷⁰. According to some authors, the food system is not only shortcoming by promoting overconsumption, but also fails to reach a billion people who are undernourished ^{70, 85}. Indeed, the wealthy industrialised countries benefit most from the current industrialised and

globalised food system ⁸⁹. The expected growth of the world population up to 9 billion people by 2050 ⁹⁰ coupled with the loss of biodiversity, ecosystem degradation and limited capabilities of the earth also are significant arguments for reconsidering our agricultural system and diets ⁹¹. A recent report on food security in the face of climate change stated that “As a global community we need to navigate toward a ‘safe operating space’ that provides adequate food and nutrition for everyone without crossing critical environmental thresholds ⁹²”.

In conclusion, the principal issue is that food prices do not fairly represent their actual costs, both with respect to their production and externalities (costs relied to others via diseases, to the undeveloped world, or the earth). When thinking about food pricing strategies, it makes sense to develop a food system in which we pay for food what it actually costs, or at least make that these costs are more transparent. In the coming years, new inter-sector studies are needed to gain insight into these multidisciplinary effects and help bringing a solution to the cross cutting issues surrounding a healthy sustainable diet for everyone ⁹¹.

Conclusion

Healthy diets are relatively expensive and food prices are an important determinant of food selection, especially among people with a relatively low SES. Based on consumer and expert consultations we found that food pricing interventions can bring a feasible and effective solution in stimulating healthier food choices. In the experimental studies it was found that especially lowering the prices of fruits and vegetables is a promising intervention strategy since it proved to substantially increase fruit and vegetable purchases while not leading to higher food purchases in other food categories. Nutrition education alone is not sufficient to stimulate fruit and vegetable purchases, but it does enhance the effects of food pricing strategies. The studies in this thesis cannot give insight into the definite health outcomes of making fruits and vegetables cheaper, but do clearly show that this strategy has positive effects on food purchases. The next challenge is to design studies that incorporate health outcomes, but also to develop a system in which these lower fruit and vegetable prices can be realized. Possible mechanisms include the provision of fruit and vegetable coupons to the lowest income groups or designing a system in which supermarket margins are fairer distributed among product categories. While the abovementioned interventions are a good place to start, we also propose that it is relevant to look at how food prices are shaped to begin with. Our food (production) system is largely economic driven and keeps going by consumption-based growth. This food system is not only

shortcoming by promoting overconsumption, but also fails to reach a billion people who are undernourished. Moreover, the expected growth of the world population up to 9 billion people by 2050 coupled with the loss of biodiversity, ecosystem degradation and limited capabilities of the earth are significant arguments for reconsidering our agricultural system and diets. The challenge is not solely to improve the quality of population diets, but also to do this in a way that is sustainable and brings health evenly to the World population and makes an end to problems both related to under-nutrition and over-nutrition.

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Location of the four participating supermarkets in the real supermarket trial